



## Sitka National Historical Park

### Background

Birds are useful indicators of ecological change because they are highly mobile and generally conspicuous. As climate in a particular place changes, suitability may worsen for some species and improve for others. These changes in climate may create the potential for local extirpation or new colonization. **This brief summarizes projected changes in climate suitability by mid-century for birds at Sitka National Historical Park (hereafter, the Park) under two climate change scenarios (see Wu et al. 2018 for full results, and Langham et al. 2015 for more information regarding how climate suitability is characterized).** The high-emissions pathway (RCP8.5) represents a future in which little action is taken to reduce global emissions of greenhouse gases. The low-emissions pathway (RCP2.6) is a best-case scenario of aggressive efforts to reduce emissions. These emissions pathways are globally standardized and established by the Intergovernmental Panel on Climate Change for projecting future climate change. The findings below are model-based projections of how species distributions may change in response to climate change. A 10-km buffer was applied to each park to match the spatial resolution of the species distribution models (10 x 10 km), and climate suitability was taken as the average of all cells encompassed by the park and buffer.

### Results

**Climate change is expected to alter the bird community at the Park, with greater impacts under the high-emissions pathway than under the low-emissions pathway (Figure 1).** Among the species likely to be found at the Park today, climate suitability in summer under the high-emissions pathway is projected to improve for 15 (e.g., Figure 2), remain stable for 21, and worsen for 14 species. Suitable climate ceases to occur for 6 species in summer, potentially resulting in extirpation of those species from the Park. Climate is projected to become suitable in summer for 7 species not found at the Park today, potentially resulting in local colonization. Climate suitability in winter under the high-emissions pathway is projected to improve for 23, remain stable for 11, and worsen for 22 species. Suitable climate ceases to occur for 2 species in winter, potentially resulting in extirpation from the Park. Climate is projected to become suitable in winter for 15 species not found at the Park today, potentially resulting in local colonization.

### IMPORTANT

This study focuses exclusively on changing climatic conditions for birds over time. But projected changes in climate suitability are not definitive predictions of future species ranges or abundances. Numerous other factors affect where species occur, including habitat quality, food abundance, species adaptability, and the availability of microclimates (see Caveats). Therefore, managers should consider changes in climate suitability alongside these other important influences.

We report trends in climate suitability for all species identified as currently present at the Park based on both NPS Inventory & Monitoring Program data and eBird observation data (2016), plus those species for which climate at the Park is projected to become suitable in the future (Figure 1 & Table 1). This brief provides park-specific projections whereas Wu et al. (2018), which did not incorporate park-specific species data and thus may differ from this brief, provides system-wide comparison and conclusions.

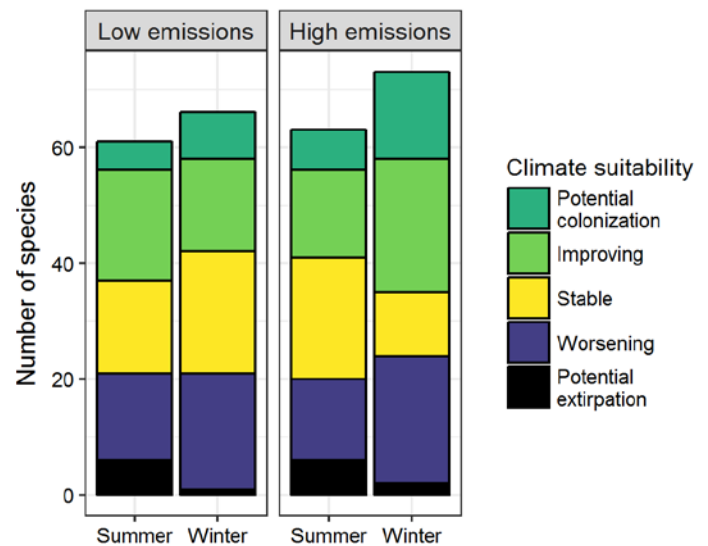


Figure 1. Projected changes in climate suitability for birds at the Park, by emissions pathway and season.

## Results (continued)

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### Potential Turnover Index

**Potential bird species turnover for the Park between the present and 2050 is 0.21 in summer (33<sup>rd</sup> percentile across all national parks) and 0.20 in winter (26<sup>th</sup> percentile) under the high-emissions pathway. Potential species turnover declines to 0.12 in summer and 0.10 in winter under the low-emissions pathway.** Turnover index was calculated based on the theoretical proportions of potential extirpations and potential colonizations by 2050 relative to today (as reported in Wu et al. 2018), and therefore assumes that all potential extirpations and colonizations are realized. According to this index, no change would be represented as 0, whereas a complete change in the bird community would be represented as 1.

### Climate Sensitive Species

The Park is or may become home to 17 species that are highly sensitive to climate change across their range (i.e., they are projected to lose climate suitability in over 50% of their current range in North America in summer and/or winter by 2050; Table 1; Langham et al. 2015). While the

### Management Implications

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Parks differ in potential colonization and extirpation rates, and therefore different climate change adaptation strategies may apply. **Under the high-emissions pathway, Sitka National Historical Park falls within the high potential extirpation group.** Parks anticipating high potential extirpation can focus on actions that increase species' ability to respond to environmental change, such as increasing the amount of potential habitat, working with cooperating agencies and landowners to

### Caveats

The species distribution models included in this study are based solely on climate variables (i.e., a combination of annual and seasonal measures of temperature and precipitation), which means there are limits on their interpretation. Significant changes in climate suitability, as measured here, will not always result in a species response, and all projections should be interpreted as potential trends. Multiple other factors mediate responses to climate change, including habitat availability, ecological processes

Park may serve as an important refuge for 16 of these climate-sensitive species, one, the American Wigeon (*Anas americana*), might be extirpated from the Park in summer by 2050.



**Figure 2.** Climate at the Park in summer is projected to remain suitable for the American Robin (*Turdus migratorius*) through 2050. Photo by Andy Reago & Chrissy McClarren/Flickr (CC BY 2.0).

improve habitat connectivity for birds across boundaries, managing the disturbance regime, and possibly more intensive management actions. Furthermore, park managers have an opportunity to focus on supporting the 16 species that are highly sensitive to climate change across their range (Table 1; Langham et al. 2015) but for which the park is a potential refuge. Monitoring to identify changes in bird communities will inform the selection of appropriate management responses.

that affect demography, biotic interactions that inhibit and facilitate species' colonization or extirpation, dispersal capacity, species' evolutionary adaptive capacity, and phenotypic plasticity (e.g., behavioral adjustments). Ultimately, models can tell us where to focus our concern and which species are most likely to be affected, but monitoring is the only way to validate these projections and should inform any on-the-ground conservation action.

## More Information

For more information, including details on the methods, please see the scientific publication ([Wu et al. 2018](#)) and the [project overview brief](#), and visit the [NPS Climate Change Response Program website](#).

## References

eBird Basic Dataset (2016) Version: ebd\_relAug-2016. Cornell Lab of Ornithology, Ithaca, New York.

Langham et al. (2015) Conservation Status of North American Birds in the Face of Future Climate Change. PLOS ONE.

Wu et al. (2018) Projected avifaunal responses to climate change across the U.S. National Park System. PLOS ONE.

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## Species Projections

**Table 1. Climate suitability projections by 2050 under the high-emissions pathway for all birds currently present at the Park based on both NPS Inventory & Monitoring Program data and eBird observation data, plus those species for which climate at the Park is projected to become suitable in the future. "Potential colonization" indicates that climate is projected to become suitable for the species, whereas "potential extirpation" indicates that climate is suitable today but projected to become unsuitable. Omitted species were either not modeled due to data deficiency or were absent from the I&M and eBird datasets. Observations of late-season migrants may result in these species appearing as present in the park when they may only migrate through. Species are ordered according to taxonomic groups, denoted by alternating background shading.**

\* Species in top and bottom 10th percentile of absolute change

^ Species that are highly climate sensitive

- Species not found or found only occasionally, and not projected to colonize by 2050

x Species not modeled in this season

Common Name	Summer Trend	Winter Trend
Cackling/Canada Goose	x	Improving
Wood Duck	-	Improving
Eurasian Wigeon	-	Potential colonization
American Wigeon	Potential extirpation <sup>^</sup>	Improving
Mallard	Stable <sup>^</sup>	Stable
Northern Shoveler	Stable <sup>^</sup>	-
Northern Pintail	Potential extirpation	-
Ring-necked Duck	-	Improving
Greater Scaup	Worsening	Worsening <sup>^</sup>
Lesser Scaup	-	Improving*
Harlequin Duck	x	Stable
Surf Scoter	x	Stable
White-winged Scoter	x	Worsening
Black Scoter	-	Worsening*
Long-tailed Duck	-	Worsening
Bufflehead	-	Worsening

Common Name	Summer Trend	Winter Trend
Common Goldeneye	x	Worsening
Barrow's Goldeneye	x	Worsening <sup>^</sup>
Hooded Merganser	-	Improving** <sup>^</sup>
Common Merganser	x	Worsening
Red-breasted Merganser	Stable	Worsening <sup>^</sup>
Ruffed Grouse	-	Potential colonization
Pacific Loon	-	Worsening
Common Loon	Stable	Stable <sup>^</sup>
Red-necked Grebe	-	Stable <sup>^</sup>
Brandt's Cormorant	-	Potential colonization
Double-crested Cormorant	x	Stable
Pelagic Cormorant	x	Worsening
Great Blue Heron	Improving	Improving
Sharp-shinned Hawk	-	Improving*
Bald Eagle	x	Stable

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Virginia Rail	-	Potential colonization
American Coot	-	Improving
Black Oystercatcher	x	Improving
Black-bellied Plover	-	Potential colonization
Killdeer	-	Potential colonization
Spotted Sandpiper	x	Potential colonization
Greater Yellowlegs	Worsening	-
Black Turnstone	x	Improving
Surfbird	x	Worsening*^
Rock Sandpiper	-	Worsening*
Long-billed Dowitcher	-	Potential colonization
Red-necked Phalarope	Potential extirpation	-
Common Murre	x	Worsening*
Pigeon Guillemot	Stable	-
Marbled Murrelet	Stable	Worsening*
Bonaparte's Gull	Stable	-
Mew Gull	Worsening	Worsening
Herring Gull	Stable	Improving^
Iceland Gull (Thayer's)	x	Stable
Glaucous-winged Gull	Stable	Worsening
Arctic Tern	Worsening	-
Rock Pigeon	Improving*	Improving
Band-tailed Pigeon	-	Potential colonization
Eurasian Collared-Dove	x	Potential extirpation
Western Screech-Owl	-	Stable
Rufous Hummingbird	Worsening	-
Belted Kingfisher	Improving	Improving
Red-breasted Sapsucker	Stable	Improving
Hairy Woodpecker	Improving	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Northern Flicker	Stable	Improving*
Merlin	x	Potential colonization^
Peregrine Falcon	-	Potential colonization
Western Wood-Pewee	Improving^	-
Willow Flycatcher	Potential colonization	-
Pacific-slope Flycatcher	Stable	-
Hutton's Vireo	-^	Potential colonization
Steller's Jay	Worsening	-
Northwestern Crow	Improving*	Worsening
Common Raven	Stable	Worsening
Tree Swallow	Improving	-
Violet-green Swallow	Improving*	Potential colonization
Barn Swallow	Improving*	-
Chestnut-backed Chickadee	Stable	Improving
Brown Creeper	Worsening*^	Potential extirpation
Pacific/Winter Wren	Stable	Worsening
American Dipper	x	Worsening*
Golden-crowned Kinglet	Stable	Improving
Ruby-crowned Kinglet	Worsening*	Potential colonization
Swainson's Thrush	Improving	-
Hermit Thrush	Worsening*	-
American Robin	Improving	Improving*
Varied Thrush	Stable^	Stable
European Starling	Improving*	Improving
Cedar Waxwing	Potential colonization	-
Worm-eating Warbler	Potential colonization	-
Blue-winged Warbler	Potential colonization	-
Orange-crowned Warbler	Worsening	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
Hooded Warbler	Potential colonization	-
Yellow Warbler	Stable	-
Yellow-rumped Warbler	Potential extirpation	-
Black-throated Gray Warbler	Potential colonization	-
Townsend's Warbler	Stable	-
Wilson's Warbler	Worsening*	-
Savannah Sparrow	Stable	-
Fox Sparrow	Worsening*	Improving
Song Sparrow	Improving*	Improving
Lincoln's Sparrow	Potential extirpation	-

<b>Common Name</b>	<b>Summer Trend</b>	<b>Winter Trend</b>
White-crowned Sparrow	Improving	Stable
Dark-eyed Junco	x	Improving
Red-winged Blackbird	Improving	-
Brewer's Blackbird	-	Potential colonization
Pine Grosbeak	Worsening^	-
Purple Finch	Potential colonization	-
Red Crossbill	Worsening^	x
White-winged Crossbill	Potential extirpation	-
Pine Siskin	Stable	Worsening*